PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Device for Inserting Wire Coils in Tapped Holes

We, AIRCRAFT SCREW PRODUCTS COMPANY, INC., a corporation under the laws of the State of New York, having a place of business at 47—23, 35th Street, Long Island City, New York, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The invention relates to a method and a tool for inserting a wire coil in a tapped hole of a boss or similar part. Coil inserts of the kind here in consideration are used for various purposes, for instance in order to provide a tapped thread in a member of relatively soft material, such as wood, aluminum, artificial matter, etc., with a hard lining resistent to the deteriorating effect of a bolt repeatedly screwed in and out of the thread convolutions. In such applications of wire coil inserts, it is usually required that the insert wire is originally coiled oversized as to its diameter in order to cause the inserted coil to engage the tapped thread groove under radial tension, and, thus, to set up considerable friction between the coil convolutions and the flanks of the tapped groove. The friction prevents or at least counteracts forces tending to shift the insert relatively to the member into which it is inserted.

The insertion of such oversized coil in a tapped hole requires contraction of the coil before it is finally in its inserted position. Hitherto, the contraction has been accomplished during and by screwing the coil into the thread of smaller diameter. In other words, the member into which the coil was to be inserted, acted, in a sense, as the tool or at least part of a tool for the contraction of the coil. This method is objectionable mainly for two reasons. On the one hand, frequently the first convolution of the tapped threading is destroyed or at least injured when the oversized insert is forced into it. On the other hand, the more the insert is advanced, the greater becomes the friction which resists the inserting operation.

The invention aims, therefore, to provide a method and means whereby a wire coil can be inserted in a tapped hole without injury to the threading and without undue friction during the insertion.

The invention consists in that the oversized wire coil is first contracted to an outer diameter smaller than the corresponding diameter of the tapped hole for which the coil is destined. Then, the coil is inserted into the tapped hole while being held thus contracted, and finally is released to spring into firm engagement with the tapped threading when in the desired relative position thereto.

The invention further consists in a tool comprising means to hold one end of a coil, and to contact the coil progressively by a relative movement of the holding means and of another means in engagement with another portion of the coil, the construction and arrangement of the parts of the tool being such that the coil can be inserted into the tapped hole while being held in a contracted state, and that it will be released to spring into firm engagement with the tapped threading when substantially its whole length is inserted.

The method of carrying the invention into practice will be apparent from the description given hereinafter and the accompanying drawing illustrating an embodiment thereof by way of example. In the drawing,

Figs. 1 and 2 are side elevation and front view respectively of an insert of the kind to which the invention relates.

Fig. 3 is a side elevation of a tool according to our invention in a position preparatory to engaging an insert to be contracted.

Fig. 4 is another side elevation of the same tool in a position in which the insert is contracted.

Fig. 5 is a front view of the tool.

Fig. 6 is a side view of a modified portion of the tool.

Fig. 7 is a longitudinal cross-section of a modification of another portion of the tool.

Referring now to the drawing, Figs. 1 and 2 show an example of an insert of the kind here in consideration. The illustrated coil 10 is wound of a wire of suitably selected, springy material. It has

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a diamond-shaped cross-section. However, it is to be understood that the wire may be of any other suitable cross-section, e.g. round, square or pear-shaped. The outer diameter of this coil is larger than the corresponding diameter of the tapped hole for which it is destined. In order to facilitate the insertion the first convolution 11 or a portion thereof may have an outer diameter slightly smaller than the remainder 12 of the coil, and in order to provide for a grip by an inserting tool, the front end of the coil may be bent inward so as to form a tang 13. In other types of inserts there may be neither a front convolution with smaller diameter nor a tang such as 13.

Now, in order to insert into a tapped hole, a coil having a diameter larger than the corresponding diameter of the tapped hole, it is necessary to reduce the coil diameter. According to the present invention this is done by gripping the one end, preferably the tang, on the one hand, and also gripping the other end of the coil, on the other hand, and turning the two gripped ends with respect to each other in such a sense as to increase the total angle of the convolutions, thereby to contract the coil. Then, the coil in its contracted state, will be substantially completely inserted into the hole and, finally, released so as to spring into close contact with the flanks and/or bottom of the tapped thread groove.

If the coil is so contracted that its outer diameter is smaller than the minimum diameter of the thread convolutions of the tapped hole, the coil may be inserted by shifting it axially in position. However, this is not always advisable, particularly if there are lands between the thread convolutions of the hole, because it may happen that the coil convolutions when released spring to bear against such lands rather than into the grooves of the thread. For this reason it is preferred to contract the coil diameter to a size only slightly smaller than the corresponding diameter of the tapped thread. Such a coil can be easily screwed into position, practically without any friction, owing to the clearance between the corresponding diameters.

The method hereinbefore described, and particularly the operation of contracting the coil may be modified in that the one end of the coil is gripped as hereinbefore described, then hold is taken of a portion of the coil close to said end. This hold is progressively shifted towards the other end while a force is simultaneously applied between the gripped end and the hold in such a sense as to increase the total angle of convolution between the gripped end and the hold. When the coil is completely contracted it is inserted and released as in the first described method. It is also possible, according to the invention first to contract a portion of the coil in the manner hereinbefore described, then to start inserting the contracted portion between the gripped end and the hold, and to continue to insert while the hold is shifted towards said other end. However, it is essential in any event, that only a pre-contracted portion of the coil is inserted and that the coil is released to spring into position only after substantially the entire contracted coil has been inserted.

The tool illustrated in Figs. 3 to 5 is designed to apply the method according to the invention. It comprises a cylindrical rod 14 of a diameter substantially equal to the inner diameter, after contraction of a coil for which the tool is destined. The front end 15 of the rod is tapered and provided with a slot 16 so shaped that it can receive the tang 13 of a coil 10. The other end is suitably shaped at 17 for the attachment of extraneous means (not shown), either manually or mechanically operated, whereby the rod may be shifted longitudinally and/or turned or held against turning. Another member 18 of the tool comprises a cylindrical portion 19 constituting a bushing with a longitudinal bore 20 in which the rod 14 has a sliding fit. The outer surface of the bushing is so shaped, for instance by knurling as indicated at 21, that it can be safely held and that a torque can be applied between the bushing and the rod 14. The front end 22 of the member 18 is cylindrical and may have the same outer diameter as the bushing 19. It is interiorly threaded at 23. The form pitch and diameter of the threading corresponds to the shape the coil 10 is intended to have when in its contracted state. The length of the end 22 is preferably selected according to three or four times the pitch of the thread. For a purpose to be described hereinafter, the end portion 22 may be provided with a recess 24. The portion 25 intermediate the portions 19 and 22 is part of a hollow cylinder whose inner wall has a diameter 26 substantially equal to that of the coil 10 in its original, i.e. non-contracted state. Hence, the diameter at 26 is larger, and the diameter of the threading 23 is smaller than the corresponding diameter of the tapped hole which is to be lined by the coil. Portion 25 is deeply recessed at 27 and of such a length that a coil 10 can be inserted from the side between the bushing 19 and end portion 22. Means may be provided in order to prevent an undesired relative movement be-

tween the rod 14 and part 18. In the illustrated embodiment, such means consists of a set screw 28 inserted into a radial tapped hole 29 of the bushing 19, and a fiber disk 30 positioned between the set screw and the rod 14 whereby a desired braking effect can be obtained. An extraneous member 31 with a hole 32 tapped at 33 is indicated in Fig. 4.

The tool may be applied in the following manner: The rod 14 is retracted in bushing 19 so that its forward end 15 does not obstruct the recess 27 as shown in Fig. 3. Then, a coil 10 is inserted into the recess with its tang-provided end towards the part 22 of the member 18. As the diameter at 26 is equal to the outer diameter of the main coil portion in its original state, the coil abutting against the inner face of the portion 25 will be in a position where it is substantially coaxial with the rod 14. The rod end 15 is, then, pushed forward, i.e. towards the left hand side in the drawing, and through the coil, if necessary while turning it relatively to the latter, so that the end of the rod catches the tang 13 in its slot 16 and shifts the coil against that face of the portion 22 which is opposite the bushing 19. Thereafter, the rod 14 is turned relatively to the bushing 19 whereby the front convolution 11 of the coil will be caused to enter the threading 23 of the portion 22. The recess 24, if provided in portion 22, permits observation of the correct entrance of the coil into the threading 23. The relative rotation of the two members of the tool is continued with the result that the coil is progressively screwed through the threading 23 so as to project from the front end of the member 18 as clearly shown in Fig. 4, thereby, the diameter of the main coil portion 12 will be reduced to that of the threading which is according to the desired dimension of the coil in its contracted state as mentioned hereinbefore. During this step of operation, the rod acts as a mandrel, its diameter being substantially equal to the inner diameter of the contracted coil. The relative rotation of the two tool members 14 and 18 is discontinued when there is still a short length of the trailing end of the coil in engagement with the threading. I have found that approximately half a convolution is sufficient to hold the rear end of the coil in such a relation to the front end that the coil remains contracted on the rod 14. The resilient force set up by contracting the coil tends to turn the tool members in the direction opposite to that in which the members were turned during the contraction. Such movement, however, is prevented by the braking action of the fiber plate 30 pressed against rod 14 by the properly adjusted set screw 28. Thus, the coil is first contracted and then held by the tool in its contracted state. Now, the tool end 15 with the contracted coil on rod 14 can be inserted in the hole 32 of a member such as 31. This can be accomplished by turning the rod 14 so as to screw the coil into the threading 33. It will be noticed that during the insertion the coil stays contracted owing to the braking means, i.e. set screw 28 pressing fiber disc 30 against rod 14. When the insertion of the coil is so far accomplished that the front face of the portion 22 bears against the face 34 of the part 31, member 18 is held stationary and rod 14 turned relatively thereto. This causes the end of the coil to leave the threading 22 and to enter the hole 32. As soon as the coil end is out of contact with the threading 23 it will spring into close engagement with the flanks of the thread groove of the tapped hole 32. The pressure of the coil convolutions on rod 14 being released owing to the expansion of the coil, the tool can be readily withdrawn. Before this is done, the tang may be removed by turning the rod in the opposite direction. Instead of passing the coil almost entirely through the threading 23 before the front end with the coil thereon is inserted in the hole 32, it is also possible to start the inserting operation when only a portion of the coil has been contracted. In the event that, after the insertion, a short piece of the coil should still project from the tapped hole, such piece may be cut off in order to make the coil end flush with the surface 34.

In Fig. 6, a modification of the braking means is shown. The member 118 which corresponds to the member 18 has a tapered rear end 40 whose maximum diameter is smaller than the diameter of the main portion of the member 118. The end 40 is provided with longitudinal slots 41 and with a conical exterior threading 42. A nut 43 is screwed on that threading. By tightening the nut more or less the friction between the end 40 and rod 14 can be adequately adjusted. Nut 43 is shown as having a diameter of the same size as the member 118 because in many cases where the tool may be used the space is so restricted that radial projections must be avoided.

Fig. 7 illustrates a modification of the part 22 and threading 23 which serves to contract a coil. In the design according to Fig. 7 the threading 223 in portion 222 of member 218 is tapered from the rear towards the front face 224. The largest diameter of this threading corresponds to the outer diameter of the coil prior to its

contraction, whereas the smallest diameter of the threading 223 corresponds to the outer coil diameter in its contracted state. It will be clear that a coil to be contracted need not have a first convolution 11 of reduced size as shown in Fig. 1 and Fig. 2; that is to say, it may have the same diameter throughout its length if threading 223 is provided which is capable of progressingly contracting the coil diameter from its maximum to its minimum diameter. In all other respects the modified tools are similar to the tool of Figs. 3 to 5.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of providing a tapped hole of a member with a wire coil insert, which comprises the steps of coiling a length of wire with an outer diameter larger than the corresponding diameter of the threading of a tapped hole for which the coil is destined, contracting the so obtained coil by increasing its total angle of convolution, inserting said coil into the tapped hole while holding the coil in its contracted state, and releasing it when inserted so as to spring into close engagement with the tapped threading.

2. A method as claimed in claim 1 characterized in that the coil is contracted to a diameter slightly smaller than the corresponding diameter of the threading and, then, screwed into the tapped hole before it is released.

3. A method as claimed in claim 1 characterized in that the coil, beginning with its front portion, is progressively contracted and the contracted portions inserted, and that the coil is released when the contraction and insertion is completed.

4. A tool for carrying through the method according to one or several of the claims 1 to 3, characterized by a first member embodying means for gripping one end of a wire coil from the interior of the latter, and a second member embodying means for holding a portion of said wire coil from its outside, both said members being co-axially arranged, and one of said members being axially shiftable and rotatable in relation to the other one, whereby a coil portion between the grip and hold of the two members respectively can be contracted if the one member is shifted and turned relatively to the other one.

5. A tool as claimed in claim 4 characterized by the provision of detaining means in engagement with the two members to prevent a relative movement of the members owing to the tension of a contracted coil portion between the grip and hold of the two members respectively.

6. A tool as claimed in claim 4 characterized in that said first member is of rod-like structure of a diameter smaller than the inner diameter of a wire coil intended to be contracted by the tool, the front end of said first member being slotted so as to receive in the slot a tang of the front end of the coil, when said front end of said first member is passed through said coil from the rear end thereof, and that said second member constitutes a bushing in which said first member is axially shiftable and rotatable, said second member embodying means for engaging and frictionally detaining a portion of said wire coil from the outside.

7. A tool as claimed in claim 6 wherein the diameter of said first member is substantially equal to the desired inner diameter of the coil after its contraction.

8. A tool according to one or several of the claims 5 to 7 characterized in that said first member is a mandrel with a slotted front end, and said second member includes a bushing in which said mandrel is axially shiftable and rotatable, said second member also including a part provided with a tapped hole through which said front end of said mandrel can be projected, the thread diameter of said tapped hole corresponding to the diameter to which said coil is intended to be contracted.

9. A tool as claimed in claim 8 wherein said tapped hole is tapered from a maximum diameter corresponding substantially to the maximum diameter of the coil prior to its contraction, to a minimum diameter corresponding to that to which said coil is intended to be contracted.

10. A tool as claimed in claim 8 characterized in that said second member has a laterally recessed portion intermediate the bushing and the part provided with said tapped hole, said intermediate portion being so shaped as to receive the non-contracted coil therein, and said mandrel being retractable, in the one direction, with its front substantially into said bushing, and projectable, in the other direction, through a coil placed in said recess, and with the coil on said end through said tapped hole.

11. A tool as claimed in one or several of the claims 8 to 10 characterized in that said part provided with the tapped hole is provided with a recess through which the threading of the hole can be observed.

12. A tool as claimed on one or several of the claims 8 to 11 characterized by the provision of screw means in engagement with said bushing so as to exercise an

adjustable clamping action on said mandrel.

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BARKER, BRETTELL & DUNCAN,
Chartered Patent Agents,
75 & 77, Colmore Row, Birmingham, 3.

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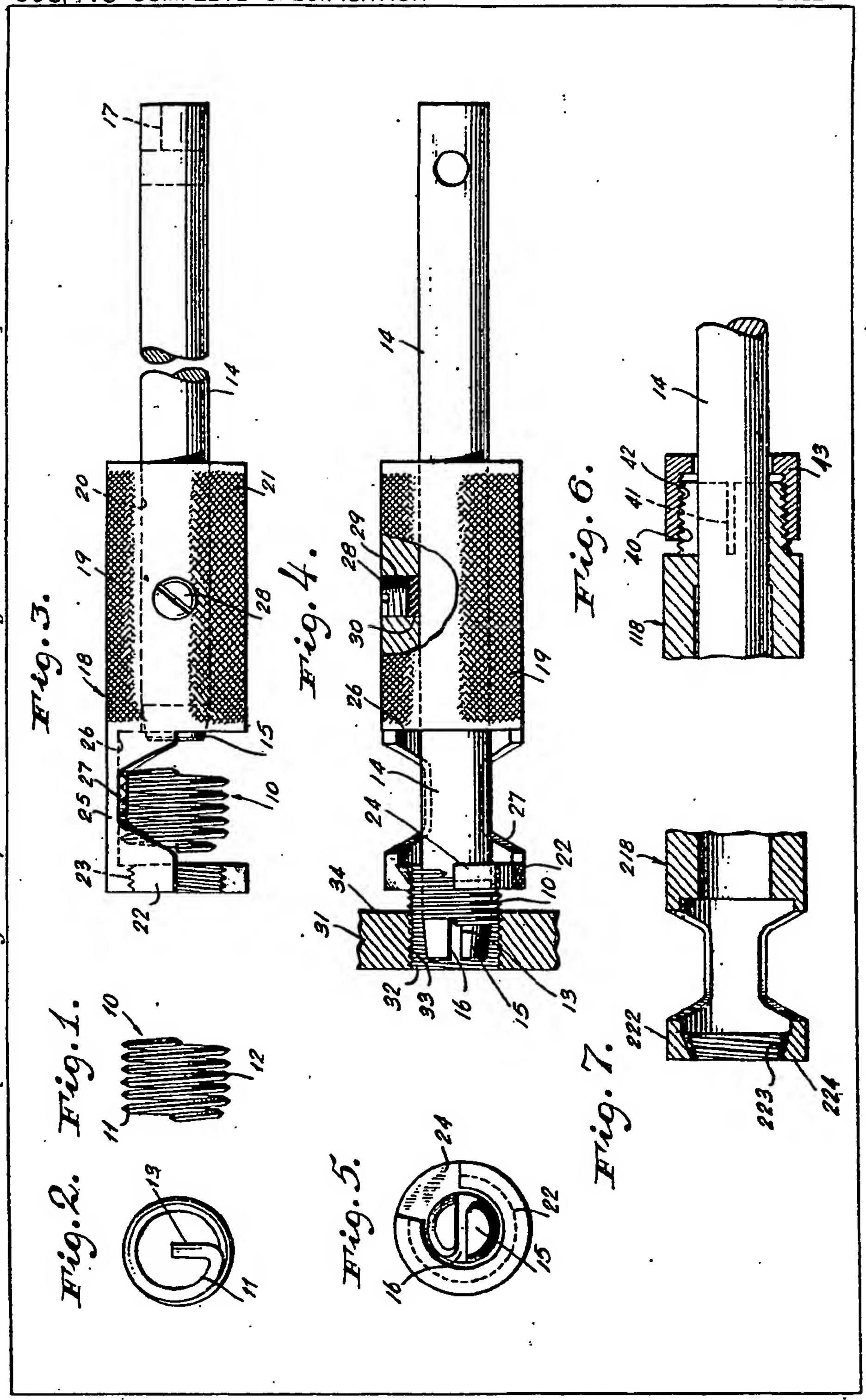
[This Drawing is a reproduction of the Original on a reduced scale.]



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